PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 03 091 WO	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/DK2004/000829	International filing date *(day/month/year)* 29.11.2004	Priority date *(day/month/year)* 28.11.2003
International Patent Classification (IPC) or both national classification and IPC F01N3/28		
Applicant RECCAT APS et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 13 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
28.09.2005	21.02.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Schmitter, T Telephone No. +31 70 340-1015

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK2004/000829

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-43	as originally filed

Claims, Numbers

2-12, 14-79	as originally filed
1, 13	received on 28.09.2005 with letter of 28.09.2005

Drawings, Sheets

1/27-27/27	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished ~~written~~ sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	4 7 12 14 23 24 25 28 29 31 32 37 38 41-46 48-55 59 61-66 69-72 74-79
	No:	Claims	1-3, 6, 8-11 13 15 16 17 18 19 20 21 22 26 27 30 33 34 35 36 39 40 47 56-58 60 67 68 73 76
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-79
Industrial applicability (IA)	Yes:	Claims	1-79
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document/s/:

D1: DE 44 14 904 C1 (MERCEDES-BENZ AKTIENGESELLSCHAFT, 70327 STUTTGART, DE) 27 April 1995 (1995-04-27)
D2: PATENT ABSTRACTS OF JAPAN vol. 1996, no. 11, 29 November 1996 (1996-11-29) & JP 08 177466 A (COSMO SOGO KENKYUSHO:KK; COSMO OIL CO LTD), 9 July 1996 (1996-07-09)
D3: PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) & JP 2003 328736 A (FUJI HEAVY IND LTD), 19 November 2003 (2003-11-19)
D4: DE 199 55 013 A1 (VOLKSWAGEN AG) 17 May 2001 (2001-05-17)
D5: US-A-5 335 492 (ZIRKEL ET AL) 9 August 1994 (1994-08-09)
D6: DE 101 37 050 A1 (ROBERT BOSCH GMBH) 28 February 2002 (2002-02-28)

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of independant method claim 1 and corresponding apparatus and use claims 13 and 73 is not new in the sense of Article 33(2) PCT.

The document D5, fig.2 discloses (the references in parentheses applying to this document) and in the wording of claim 1 a method for treatment of a fluid quantity including chemical reacting means such as combustible materials above a certain minimum quantity in a high heat capacity catalytic device, said method comprises the steps of entering said fluid quantity into the catalytic device (col.1, l. 14-44) through an inlet, controlling the temperature in one or more passage sections of said catalytic device including at least one reaction passage section, said high heat capacity being established by high mass of the device (see col.2 l. 35-47) in relation to the mass flow of the fluid, said device including heat transferring rods, plates and/or substantially parallel pipes at a number between 20 and 5000 (col. l.53), and emitting the treated fluid quantity from the catalytic device through an outlet.

Therefore the subject-matter of independant method claim 1 is not new in the sense of

Article 33(2) PCT and the same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding apparatus and use claims 13 and 73.

Dependent claims 2-12, 14-72 and 74-79 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty or inventive step, see documents D1 to D4 and D6 and the corresponding passages cited in the search report.

Claims

1. Method for treatment of a fluid quantity including chemical reacting means such as combustible materials above a certain minimum quantity in a high heat capacity catalytic device, said method comprises the steps of

entering said fluid quantity into the catalytic device through an inlet,

controlling the temperature in one or more passage sections of said catalytic device including at least one reaction passage section, said high heat capacity being established by high mass of the device in relation to the mass flow of the fluid, said device including heat transferring rods, plates and/or substantially parallel pipes at a number between 20 and 5000,

and

emitting the treated fluid quantity from the catalytic device through an outlet.

2. Method according to claim 1 wherein the temperature directly or indirectly controls the opened or closed position of at least one valve in said catalytic device.

3. Method according to claim 2 wherein said at least one valve controls the flow path of the fluid in said catalytic device.

4. Method according to claim 2 or 3 wherein said at least one valve opens or closes a connection between said at least one reaction passage section and the outlet as a result of the temperature.

5. Method according to any of claims 2 to 4 wherein said at least one valve opens or closes in response to the temperature of the fluid flowing by temperature dependent connection means in said at least one valve.

6. Method according to claim 5 wherein the fluid always flows through, by or in the proximity of the temperature dependent connection means.

7. Method according to any of claims 1 to 6 wherein a valve control signal is established by measuring the temperature inside one or more of said passage sections, one or more turning chambers and/or said inlet.

8. Method according to claim 7 wherein the valve control signal is established on the basis of the temperature difference between one or more of said passage sections, one or more turning chambers and/or said inlet.

9. Method according to claim 7 or 8 wherein the valve control signal is established in relation to a predefined temperature threshold signal.

10. Method according to any of claims 1 to 9 wherein said at least one reaction passage sections heat exchange with a main heat transfer passage section, and/or where said at least one reaction passage sections heat exchange with one or more preceding inlet passage sections and/or one or more succeeding outlet passage sections.

11. Method according to any of claims 1 to 10 wherein the fluid quantity is directed through the succeeding passage sections in counterflow.

12. Method according to any of claims 1 to 11 wherein further combustible material is added directly or indirectly to the catalytic device.

13. Catalytic device (1) for treatment of a fluid quantity including chemical reacting means such as combustible materials above a certain minimum quantity, said device comprising

at least one inlet (2) and outlet (8) for said fluid quantity, and

one or more passage sections (3, 5, 11, 22) including at least one reaction passage section comprising catalytic material (4) of one or more kinds,

c h a r a c t e r i s e d i n t h a t

said device further comprises integrated heat transfer means for controlling the temperature in one or more of said at least one passage sections (3, 5, 11, 22, 42),

said means control the temperature by high heat capacity established by high mass of the device in relation to the mass flow of the fluid, and

said means includes heat transferring rods, plates (37) and/or substantially parallel pipes at a number between 20 and 5000.

14. Catalytic device (1) according to claim 13, c h a r a c t e r i s e d i n t h a t said catalytic device comprises one passage section (42).

15. Catalytic device (1) according to claim 13 or 14, c h a r a c t e r i s e d i n t h a t said means includes heat transferring rods and/or plates (37) e.g. between 20 and 5000 rods preferably between 50 and 1000 rods and/or between 5 and 1000 plates preferably between 10 and 200 plates.

16. Catalytic device (1) according to claim 15, c h a r a c t e r i s e d i n t h a t said heat transferring rods and/or plates (37) are made of a material

with god heat transferring qualities such as cobber, steel, aluminium or other metals.

17. Catalytic device (1) according to claim 13, characterised in that said catalytic device comprises at least two passage sections (3, 5, 11, 22).

18. Catalytic device (1) according to any of claims 13 to 17, characterised in that said means control the temperature by high heat capacity established by high mass of the device in relation to the mass flow of the fluid.

19. Catalytic device (1) according to any of claims 13 or 18, characterised in that said device includes at least one outer layer of insulating (13).

20. Catalytic device (1) according to any of claims 17 to 19, characterised in that said means include positioning of said passage sections (3, 5, 11, 22) in order to form at least one internal heat exchanger (h) with mutual heat exchange between the sections (3, 5, 11, 22).

21. Catalytic device (1) according to any of claims 17 to 20, characterised in that said means for controlling the temperature includes at least one temperature controlled valve (26).

22. Catalytic device (1) according to any of claims 17 to 21, characterised in that said catalytic device comprises three passage sections (3, 5, 11, 22).

23. Catalytic device (1) according to any of claims 17 to 22, characterised in that said catalytic device comprises four passage sections (3, 5, 11, 22).

24. Catalytic device (1) according to claim 23, characterised in that said fourth passage section (22) is a last outlet passage section surrounding the previous passage sections (3, 5, 11, 22).

25. Catalytic device (1) according to any of claims 21 to 24, characterised in that at least one turning chamber (9) between two of said passage sections (3, 5) comprises a connection to the outlet (7,8), such as an exhaust pipe section (28), controlled by said at least one temperature controlled valve (26).

26. Catalytic device (1) according to any of claims 21 to 25, characterised in that each of said at least one temperature controlled valve (26) comprises a closing member (31) and temperature dependent connection means (29) connecting said closing member and an anchoring point (30).

27. Catalytic device (1) according to claim 26, characterised in that said temperature dependent connection means (29) is a spring made in bimetal or a similar temperature dependent material.

28. Catalytic device (1) according to claim 26 or 27, characterised in that said temperature dependent connection means (29) partly or totally is positioned in the outlet e.g. in an outlet pipe (8) such as the outlet passage sections (22), valve pipe section (27), exhaust pipe section (28) or the outlet pipe section (25).

29. Catalytic device (1) according to claim 28, characterised in that said outlet pipe (8) comprises a valve pipe section (27) including at least one valve, an outlet pipe section (25) connected to the outlet chamber (7), in which both pipe sections are connected to said exhaust pipe section (28).

30. Catalytic device (1) according to any of claims 26 to 29, characterised in that said temperature dependent connection means (29) partly or totally is positioned in proximity of the connection between said pipe sections (25, 27) or in the exhaust pipe section (28).

31. Catalytic device (1) according to any of claims 21 to 30, characterised in that said device includes temperature-measuring means (33, 36) measuring the temperature inside one or more of said passage sections, one or more turning chambers and/or said inlet.

32. Catalytic device (1) according to claim 31, characterised in that valve control means (34) controls the position of said at least one temperature controlled valve (26) on the basis of temperature values from said temperature-measuring means (33, 36).

33. Catalytic device (1) according to any of claims 17 to 32, characterised in that said at least one reaction passage sections establishes a heat exchanger with a main heat transfer passage section, and/or said at least one reaction passage sections establishes a heat exchanger with one or more preceding inlet passage sections and/or one or more succeeding outlet passage sections.

34. Catalytic device (1) according to claim 33, characterised in that said one or more inlet passage sections (11) is positioned above,

alongside or outside said reaction passage section (3) e.g. by surrounding said section.

35. Catalytic device (1) according to claim 33, characterised in that said one or more outlet passage sections (22) is positioned above, alongside or outside said reaction passage section (3) e.g. by surrounding said section.

36. Catalytic device (1) according to any of claims 33 to 35, characterised in that said reaction passage section (3) is positioned above, alongside or outside said main heat transfer passage section (5) e.g. by surrounding said section.

37. Catalytic device (1) according to any of claims 33 to 36, characterised in that said reaction passage section (3) heat exchanges with said main heat transfer passage section (5) of said at least two passage sections (3, 5, 11, 22).

38. Catalytic device (1) according to claim 37, characterised in that said reaction passage section (3) heat exchanges with said main heat transfer passage section (5) in counterflow.

39. Catalytic device (1) according to any of claims 33 to 38, characterised in that said reaction passage section (3) heat exchanges with said one or more previous inlet and/or succeeding outlet passage sections (11, 22).

40. Catalytic device (1) according to claim 39, characterised in that said reaction passage section (3) heat exchanges with said one or more inlet passage sections (11) in counterflow.

41. Catalytic device (1) according to any of claims 33 to 40, characterised in that said reaction passage section (3) heat exchanges with said one or more outlet passage sections in concurrent flow.

42. Catalytic device (1) according to any of claims 17 to 41 characterised in that said device comprises at least one layer of insulation (12) between said at least two passage sections (3, 5, 11, 22).

43. Catalytic device (1) according to claim 42, characterised in that said at least one layer of insulation (12) is positioned between said reaction passage section (3) and said one or more inlet passage sections (11).

44. Catalytic device (1) according to any of claims 33 to 43, characterised in that the cross-sectional area of said reaction passage section (3) is between 0.5 and 100 times, such as between 10 and 25 times, preferably about 20 times, the cross-sectional area of said main heat transfer passage section (5) and/or said inlet or outlet passage sections (11, 22) are between 0.5 and 100 times, the cross-sectional area of said main heat transfer passage section (5).

45. Catalytic device (1) according to any of claims 33 to 44 characterised in that the cross-sectional area of the main heat transfer passage section (5) is between 0.5 and 10 times, such as 1.5 to 2.5 times, preferably about 2 times, the cross-sectional area of the inlet (2) of the catalytic device, said inlet pipe (2) being the exhaust pipe for the connected internal combustion engine.

46. Catalytic device (1) according to any of claims 13 to 45, characterised in that at least one of said passage

sections (3, 5, 11, 22) comprises one or more wall flow filters (21) with numerous porous walls (16) allowing fluid quantity (15) to penetrate through the walls.

47. Catalytic device (1) according to any of claims 13 to 46, characterised in that said at least one passage sections, such as said main heat transfer passage section (5), comprises one or more substantially parallel pipes.

48. Catalytic device (1) according to claim 47, characterised in that said main heat transfer passage section (5) is integrated as a number of pipes in said reaction passage section (3).

49. Catalytic device (1) according to claim 47 or 48, characterised in that said number of pipes is between 20 and 5000 pipes and preferably between 50 and 1000 pipes.

50. Catalytic device (1) according to any of claims 47 to 49, characterised in that said pipes form symmetrical patterns such as triangular, quadrangular or similar patterns or random patterns.

51. Catalytic device (1) according to any of claims 47 to 50, characterised in that said pipes is surrounded by catalytic material (4) ~~deposited~~ on one or more carrier means (17-21).

52. Catalytic device (1) according to any of claims 47 to 51, characterised in that said pipes comprise a circular, an oval, a triangular, a four-sided or any similar regular or irregular cross sectional shape.

53. Catalytic device (1) according to any of claims 13 to 52, characterised in that at least one passage sections, such as said main heat transfer passage section (5), comprises one or more lamellar plates.

54. Catalytic device (1) according to claim 53, characterised in that said one or more lamellar plates form non-circular canals e.g. with a cross sectional shape formed by triangles, four sided shapes, combinations hereof or similar shapes.

55. Catalytic device (1) according to claim 53 or 54, characterised in that indentations in the surface of said one or more lamellar plates form longitudinal or diagonal patterns.

56. Catalytic device (1) according to any of claims 13 to 55, characterised in that said catalytic material (4) is deposited on one or more carrier means (17-21) in at least one of said at least one passage sections (3, 5, 11, 22, 42).

57. Catalytic device (1) according to claim 56, characterised in that said one or more carrier means (17-21) are made in metal, ceramic, glass or other heat resistant materials as well as combinations of the mentioned materials.

58. Catalytic device (1) according to claim 56 or 57, characterised in that said one or more carrier means (18) include at least one shape such as spherical, cylindrical or quadrangular shapes as well as saddle, ring, regular or irregular shapes.

59. Catalytic device (1) according to any of claim 56 to 58, characterised in that said one or more carrier means

(17-21) include a number of regular or irregular pellets or balls (18) in layers (L) across one of said passage sections, each layer being positioned perpendicularly between two adjacent pipes, and each of said layers comprising 2 to 6 pellets, such as 2 to 4 and preferably between 2 and 3.

60. Catalytic device (1) according to any of claims 56 to 59, characterised in that said one or more carrier means (17-21) include monoliths (19, 21) or fibres (17, 20).

61. Catalytic device (1) according to claim 60, characterised in that said fibres (17, 20), deposit with said catalytic material form a tangled bundle of fibres partly or totally filling one or more of said passage sections.

62. Catalytic device (1) according to claim 60 or 61, characterised in that said monoliths (19, 21) or fibres (17, 20), deposit with said catalytic material (4) form longitudinal monoliths or fibres inside one or more of said at least one passage sections (3, 5, 11, 22, 42).

63. Catalytic device (1) according to any of claims 56 to 62, characterised in that said reaction passage section (3) of said at least one passage sections (3, 5, 11, 22, 42) comprises one or more kinds of said catalytic material (4) deposit on said carrier means (17-21).

64. Catalytic device (1) according to any of claims 56 to 63, characterised in that said one or more inlet and/or outlet passage sections (11, 22) of said at least two passage sections (3, 5, 11, 22) comprises one or more kinds of said catalytic material (4) deposit on said carrier means (17-21).

65. Catalytic device (1) according to any of claims 56 to 64, characterised in that said at least one passage sections (3, 5, 11, 22, 42) comprise combined carrier means including wall flow filters (21), fibres (17, 20), pellets or balls (18) and/or monoliths (19) e.g. 1/3 passage section as wall flow filters and the rest of the section as fibres, pellets or balls or monoliths.

66. Catalytic device (1) according to any of claims 56 to 65, characterised in that said combined carrier means are positioned in continuation of each other through one or more of said at least one passage sections (3, 5, 11, 22, 42).

67. Catalytic device (1) according to any of claims 56 to 66, characterised in that said catalytic material (4) includes metal or metal alloys from the Platinum metal group such as Platinum (Pt), Palladium (Pl), Rhodium (Rh) or combinations hereof.

68. Catalytic device (1) according to any of claims 56 to 67, characterised in that said catalytic material (4) includes metal oxides such as Gold (Au), Platinum (Pt), Silver (Ag), Aluminium (Al), Lead (Pb), Zirconium (Zr), Copper (Cu), Cobalt (Co), Nickel (Ni), Iron (Fe), Cerium (Ce), Chrome (Cr), Tin (Sn), Manganese (Mn) and Rhodium (Rh) Oxides or combinations hereof.

69. Catalytic device (1) according to claim 67 or 68, characterised in that said catalytic material (4) includes combinations of metal or metal alloys from the Platinum metal group and metal oxides.

70. Catalytic device (1) according to any of claims 13 to 69 characterised in that further combustion material is added to the catalytic device, e.g. through a fuel line (S4) connected to the

fuel tank and the fuel supplying means (S1), or through adding further combustion material to the fluid quantity.

71. Catalytic device (1) according to any of claims 13 to 70 characterised in that material establishing a high temperature is added to the catalytic device in order to clean said catalytic device e.g. through adding combustible gas to the fluid quantity.

72. Catalytic device (1) according to any of claims 13 to 70 characterised in that at least one of said at least one passage sections (3, 5, 11, 22, 42) comprises at least one cleaning area (40) free of rods, plates or pipes.

73. Use of a method for treatment of a fluid quantity comprising chemical reacting means such as combustible materials above a certain minimum quantity in a catalytic device according to any of claims 1 to 12 for cleaning exhaust gas from internal combustion engines.

74. Use of a method for treatment of a fluid quantity comprising chemical reacting means such as combustible materials above a certain minimum quantity in a catalytic device according to any of claims 1 to 12 for temperature regulation or control in connection with any exothermal or endothermal chemical reaction in an industrial chemical application.

75. Use of a method for treatment of a fluid quantity comprising chemical reacting means such as combustible materials above a certain minimum quantity in a catalytic device according to any of claims 1 to 12 for temperature regulation or control in or in connection with fuel cells.

76. Use of a catalytic device according to any of claims 13 to 72 in connection with combustion engines in vehicles such as engines fuelled by petrol, diesel, natural gas, bottled gas or any gaseous, liquid or solid fuels.

77. Use of a catalytic device according to any of claims 13 to 72 in connection with stationary combustion engines such as engines fuelled by petrol, diesel, natural gas, bottled gas or any gaseous, liquid or solid fuels such as in power plants e.g. combined heat and power plants.

78. Use of a catalytic device according to any of claims 13 to 72 in connection with any exothermal or endothermal chemical reaction in an industrial application.

79. Use of a catalytic device according to any of claims 13 to 72 in temperature regulation or control in or in connection with fuel cells.